Appl. No. 09/675,427
Amdt. dated April 11, 2005
Supplemental Amendment

Amendments to the Specification:

Please replace the first full paragraph on page 3 (lines 4-13) with the following amended paragraph:

First, they model the matching properties of MOSFET "*macro*" characteristics, such as threshold voltage ~~(V_{Th})~~ (V_{Th}) or saturation current (I_{DSAT}) that are only indirectly related to the actual "*lowlevel*" parameters of most widely used compact SPICE (System Program for Integrated Circuits Emphasis) simulation models, such as BSIM3v3 (*"MOSFET Modeling and BSIM User Guide, Cheng, Y. and Hu, C., Kluwer Academic Publishers, Boston, 1999,* incorporated by reference as if fully set forth herein) or MOS9 (*"Compact Modeling for Analogue Circuit Simulation", Velghe, R., et al., IEDM Tech. Digest, pp. 485488, 1993,* incorporated by reference as if fully set forth herein). Therefore, a nontrivial inverse modeling process must be applied to extract the proper covariance structure of lowlevel SPICE model parameters corresponding to the available matching characterization data for these macro parameters.

Please replace the first full paragraph on page 4 (lines 9-15) with the following amended paragraph:

The problem associated with the large dimensionality of the mismatch simulation task has not yet been properly addressed. The σ-space approach of Michael and Ismail (cited above), which can be proven to be equivalent to the Choleski factorization technique used by Felt et al. (cited above), requires [[$\sum_{i=1}^{nd}(N(m_j)-1) X N(p_j)$]] $\sum_{j=1}^{nd}(N(m_j)-1) X N(p_j)$ different RVs, where, $N(m_j)$ is the number of matched devices of type j, $N(p_j)$ is the number of independent process factors used in the model of the jth device type, and *nd* is the number of different devices in the circuit.

PH1\1426575.1

Appl. No. 09/675,427
Amdt. dated April 11, 2005
Supplemental Amendment

Please replace the last paragraph on page 6 with the following amended paragraph:

Figure 3 is a block diagram of a digital to analog converter used for illustrating the method of the present invention on circuits involving matching of more ~~that~~ than two components at a time.

Please replace the paragraph bridging pages 8 and 9 (page 8 line 13 to page 9 line 5) as follows:

represents the fraction of the variance explained by the first q PCs. By replacing the model parameters ~~$(p_1, \ldots, p_n)$~~ $\underline{(p_1, \ldots, p_m)}$ by PCS $(f_1, \ldots, f_k)$ in the Eq. (1) one gets a $nk \times nk$ size matrix, where typically $k \ll m$. The reduction in the matrix size stems from the application of a suitable threshold filtering algorithm based on Eq. (2). However, further simplifications are possible because using PCS instead of model parameters makes the correlation matrix very sparse. Because the PCS are independent, the correlation between different factors for the same component is zero, i.e., $\rho_{il,m} = 0$ for $l \neq m$. Moreover, since the PCS are considered to represent independent sources of variations, correlation between different parameters on different transistors is also taken to be zero., i.e., $\rho_{ij,kl} = 0$ for $i \neq k$ and $j \neq l$. This leaves only one set of nonzero entries in the correlation matrix between the same factor for different matched components, i.e., ρ_{iljl}.

PHI\1426575.1

Please replace the paragraph bridging pages 11 and 12 (page 11, line 17 to page 12, line 7) as follows:

The method of the ~~percent~~ present invention can be used as part of the Circuit Surfer statistical design and verification environment. This environment supports many tasks typically required for analog and mixedsignal design for manufacturability, such as statistical simulation, sensitivity analysis, response surface modeling, and circuit optimization for manufacturability. Mismatch simulation is implemented in this environment as an annotation of the circuit netlist to specify the matched components, and annotations to the statistical SPICE models to include the effect of mismatch. The annotated netlist and SPICE models are used to derive a separate statistical SPICE model for each component using the twolevel PCA. The modified netlist forms the input to Circuit Surfer. This implementation enables all the capabilities of statistical design for mismatch analyses such as variable screening, response surface modeling and MonteCarlo using mismatch factors, and optimization of a design to reduce its mismatch sensitivity.

Please delete the Abstract in its entirety and substitute therefor the new abstract on the following sheet: